

ARTS Quarterly

2001 Grant Awards



Three grants were awarded for rubberized asphalt projects during the 2000/2001 grant cycle. These project applications were reviewed by the ARTS staff and then proposed to and accepted by the SC DHEC Waste Tire Committee. These agencies worked closely with Kevin Vaughan, Program Administrator, to prepare the required information for bidding. ARTS will continue to work with them throughout the projects to create the mix design and ensure quality control.

A brief progress report on each project follows:

Anderson County

- Sloan Construction has been selected as the contractor.
- ARTS is in the process of performing the mix design and should be completed by early June.
- Construction is expected to begin by the end of June and should take less than one month.

(Continued on page 6)

Inside this issue:	
Asphalt Rubber in Surface Treatments	2
Production of Crumb Rubber Modifier	3
Chipped Tires in Light-weight Embankments	4
SCDHEC Gets WasteWise	5
Recycling Market Development Advisory Council	5
Grant Awards, continued	6

Benefits of CRM

Crumb Rubber retains its inherent characteristics, including: resistance to mold and mildew, heat and humidity, retarding the development of bacteria, resistance to sunlight or ultra-violet rays, oils, many solvents, acids and other chemicals.

-European Tyre Recycling Association (ETRA)

ARTS Offers Personalized Seminars

Is your organization interested in learning more about using recycled tires in civil engineering applications? Team members of ARTS will come to your office and present information tailored to your specific questions, or to discuss a potential project. ARTS has offered general seminars on the Basics of Rubberized Asphalt and Civil Engineering Applications for Crumb Rubber in formal classroom settings. If you are interested in any of these topics, please contact Wendy Franzese in the ARTS office. ?

A New Way to Control Cracking

SAMI, which stands for **Stress Absorbing Membrane Interlayer**, is a surface treatment that can be highly effective in stopping reflective cracking. SAMIs, which have been in use since the early 1970s in Arizona, are defined as a surface treatment that is placed prior to overlaying a road with hot mix asphalt. They are designed to resist the stress and strain of reflective cracks and delay the propagation of cracks through the new overlay.

A typical SAMI is constructed by spraying a thick layer of asphalt rubber on the roadway to be resurfaced. This asphalt rubber, which contains 20% to 30% crumb rubber, is applied at a rate of approximately 0.6 - 0.8 gal/sy (gallons per square yard). This is immediately covered with aggregate at a rate of 30 - 40 lbs/sy and rolled. This type of surface treatment is effective in stopping reflective cracking for several reasons. For one, the thick layer of asphalt rubber is very effective in sealing and waterproofing cracks.

Secondly, the addition of the crumb rubber in the asphalt gives the SAMI elasticity that helps in absorbing the stress and strain that causes reflective cracking. Finally, the highly adhesive characteristic of asphalt rubber greatly improves the retention of the cover aggregate. This in turn reduces the aggregate loss during construction that can occur with typical surface treatments.



This tanker is preparing to applying an ARMI in Florida



SAMI, which stands for **Stress Absorbing Membrane Interlayer**, is a surface treatment that is placed prior to overlaying a road with hot mix asphalt, and can be highly effective in stopping reflective cracking.

In the past few years, SAMIs have been used in Florida as well. Florida DOT's version of a SAMI is called an ARMI, or Asphalt Rubber Membrane Interlayer. This surface treatment has been quite effective in slowing or stopping reflective cracking in typical overlays, and has seen wide use throughout the state of Florida.

Another version of a SAMI is the SAM, which stands for Stress Absorbing Membrane. The SAM, which is constructed just like a SAMI, is a maintenance tool that is used as a final wearing course. SAMs are used like typical surface treatments and are placed on cracked roads to extend the service life of the road. By applying a SAM, the cracks in the old road are sealed, and a durable, flexible wearing course is placed on the road. SAMs have been used in Arizona since the late 1960s.

For more information on SAMs, SAMIs, and ARMIs, contact ARTS.?

ARTS Staff:

Serji Amir Khanian, Ph.D., Director

Frank Eskridge, P.E., Assistant Director

Kevin Vaughan, Program Administrator

Wendy Franzese, Administrative Assistant

110 Lowry Hall, Box 340911, Department of Civil Engineering, Clemson University, Clemson, SC 29634-0911

PH: 864.656.6799

FAX: 864.656.2670

E-mail: arts@ces.clemson.edu

Website: www.ces.clemson.edu/arts

ARTS Quarterly is published four times each year by the Asphalt Rubber Technology Service at Clemson University. ARTS is funded through a grant from SC's Department of Health and Environmental Control and the City of Clemson. Any opinions, findings, conclusions or recommendations presented in **ARTS Quarterly** are those of the authors and do not necessarily reflect the views of Clemson University, DHEC or the City of Clemson.

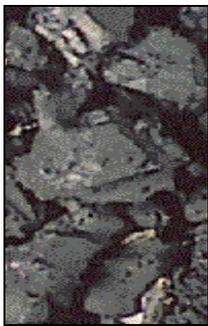
Production of Crumb Rubber Modifier

Crumb Rubber Modifier (CRM) is the term used to describe ground waste tire rubber used in Hot Mix Asphalt and other paving applications. Crumb Rubber Modifier (CRM) material can be produced several different ways:

- Ambient Grinding
- Cryogenic Grinding
- Wet Grinding



Shred-Tech ST-500H Transportable Shredding System



1/2" pieces (#12 mesh)

Each of these methods requires that the whole tires first be fed through a shredder and then a chopper to reduce the chip size to approximately 3" to 1/2" pieces. Once this is accomplished, any one of the grinding processes can be utilized.

Ambient Grinding

Ambient Grinding requires that the CRM be sized at ambient room temperature. This is generally accomplished with a series of grinders and screens to size the material, magnets to remove any residual steel, and some form of fiber removal system. Ambient Grinding can produce material ranging in size from 1/4" mesh to #40 mesh. Ambient Grinding produces a material with a very rough surface texture. This rough surface texture reacts more thoroughly with asphalt cements, thus resulting in a more desirable Asphalt Rubber binder.

Cryogenic Grinding

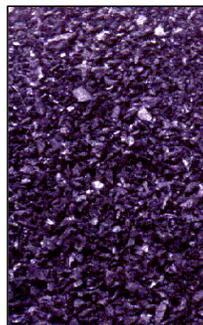
Cryogenic Grinding is similar to ambient grinding with the exception that the waste rubber is first cooled and made brittle with liquid nitrogen. This cooled rubber can then be sized quite easily with a process similar to the Ambient Grinding process.

Cryogenic Grinding can produce material ranging in size from 1/4" mesh to #100 mesh. Cryogenic Grinding produces a material with a very smooth surface texture which reacts less thoroughly with asphalt cements than ambiently ground CRM.

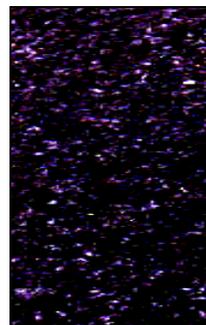
Wet Grinding

Wet Grinding utilizes an already ground, coarse CRM material in a wet slurry. This slurry is then ground between grinding stone. This process is useful due to the fact that it can produce a finer material (1/4" mesh to #100 mesh) than normal ambient grinding, but it still retains the rough surface texture of a normal ambient ground material. This finer material with a rough surface texture results in a very thorough reaction with

asphalt cement, but must be dried before it can be used. ?



2mm-0.5 mm (#10-35mesh)



0.5 mm (#35 mesh)

Tire Chip photos used with permission of RUMAL.

Chipped Tires In Lightweight Embankments

When people talk about using recycled tires in highway construction, rubber modified asphalt is quite often the only option that is discussed. Waste tires however can be used in a variety of ways in building roads. One of the most innovative is using chipped tires as lightweight fill material for embankments.

yard of fill. One project completed in Maine used 200,000 tires in a 400 foot long embankment.

The chipped tires that are used in lightweight fills are much larger than the crumb rubber used for rubber modified asphalt. Typically, chipped tires in the lower portion of the fill are 75% passing

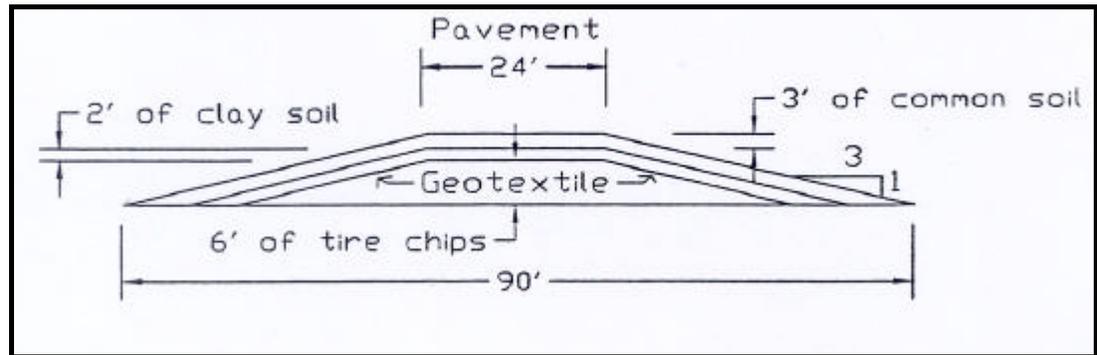
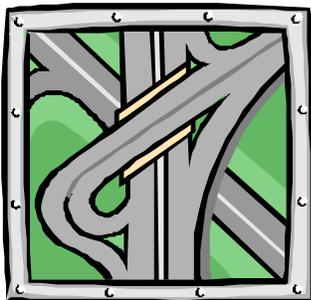


Figure 1: Typical Chipped Tire Lightweight Embankment

Using chipped tires as a fill material has several advantages. One of the most obvious is that chipped tires are extremely lightweight when compared to standard fill materials. Compacted, chipped tires have a dry unit weight ranging from 38 pcf to 43 pcf (per cubic foot). This is significantly less than most compacted soils that have a dry unit weight of approximately 125 pcf. With this low unit weight, chipped tire fills can be used in embankments over soft or weak foundation materials to prevent settling and increase the stability of the embankment.

Another advantage in using chipped tires as fill material is that a large volume of tires can be recycled. For example, a tire fill that has a unit weight of 43 pcf can use approximately 73 tires per cubic



the 8 inch sieve and around 25% passing the 1½ inch sieve. In the upper part of the fill, 100% of the chips are required to pass the 2 inch sieve with 99% retained on the #4 sieve.

A typical chipped tire fill is shown in Figure 1. In order to contain the chipped tires and to prevent contamination from underlying or overlying soils, the compacted chips are enclosed in a geotextile membrane. To protect the chips from air and water, the fill is then covered with a minimum of 2 feet of clay soil and 3 feet of common soil. Although the tires only make up the central core of the fill, the overall weight of the embankment can be significantly reduced while also recycling thousand of tires.

The advantage of the low unit weight of chipped tires as well as the recycling opportunities make chipped tires a very feasible alternative in constructing lightweight embankments. ?



SC DHEC is WasteWise

Excerpts taken from Donna Bowman's article in *South Carolina Recycles Magazine*, Winter 2001

DHEC has become a partner and endorser of the Environmental Protection Agency's WasteWise program. WasteWise is a free, voluntary partnership program that helps organizations prevent waste, recycle and buy or manufacture recycled products, thus benefiting their bottom line and the environment. The program is flexible and allows partners to design their own plans tailored to their needs. Established in 1994, WasteWise now has more than 1,000 partners, including local, state, and tribal governments, non-profit organizations, hospitals, universities and multi-national corporations. Since the program's inception, partners have removed more than 35 million tons from the municipal solid waste stream through recycling and waste prevention activities. South Carolina has 14 partners in all areas of business throughout the State.

Some of DHEC's WasteWise Goals include:

- ? Promoting electronic file storage
- ? Promoting use of e-mail archive instead of printing out emails
- ? Encouraging double-sided copying
- ? Using a copy machine instead of a laser printer (copiers use less energy than laser printers)
- ? Promoting use of fax-it notes instead of fax cover sheets
- ? Turning off lights, computer monitors, and PCs when leaving the office for an extended period of time
- ? Turning off conference room lights when not in use.
- ? Continue recycling paperboard, aluminum, steel cans, and office paper
- ? Continue purchase of recycled computer and copier paper
- ? Continue promoting purchasing programs that target materials with high post-consumer materials content.
- ? Add at least one new recyclable item for collection each year. ?



Recycling Market Development Advisory Council

The Recycling Market Development Advisory Council (RMDAC) is a fourteen member group, consisting primarily of recycling industry representatives from both the public and private sectors. Its mission is to assist in the development of markets in South Carolina for recovered materials and products with recycled content with the primary objectives of improved solid waste management, resource conservation, and economic development.

Appointed by the Governor, the RMDAC reports annually on the current status of the recycling industry in South Carolina, barriers affecting recycling, and recommendations to facilitate market development. Managed within the Department of Commerce, the Council is well positioned to coordinate economic development and recycling programs into a unified recycling market development effort. Among the Council's four committees, the Tire Committee's objective is to develop markets for scrap tire rubber, with a focus on higher value-added applications for the material. ?



For more information on WasteWise, call Donna Bowman at 1-800-768-7348 or e-mail at bowmande@columb34.dhec.state.sc.us.

Donna is the WasteWise coordinator for SC Department of Health and Environmental Control (DHEC)'s Office of Solid Waste Reduction and Recycling.

Asphalt Rubber Technology
Service

Clemson University
Civil Engineering Department
110 Lowry Hall
P.O. Box 340911
Clemson, SC 29634-0911

Phone: 864-656-6799
Fax: 864-656-2670
Email: arts@ces.clemson.edu

Address Correction Requested

PRESORT STANDARD
U.S. POSTAGE
PAID
Clemson, SC
Permit No. 10



We're on the Web!
www.ces.clemson.edu/arts

2000/2001 Grant Projects, cont.

(Continued from page 1)

Pickens County School District

- New construction and resurfacing will be performed at:
Hagood Elementary,
Dacusville Elementary, and
the new Clemson Elementary.
Additional projects may be added.
- Sloan Construction has been selected as the contractor.
- Construction is expected to begin by the end of June or early July.

South Carolina Botanical Gardens

- New paving and resurfacing of roads and parking areas in the SC Botanical Gardens will be performed this summer.
- This project will be awarded soon.
- More information concerning the project start date and duration will be available when a contractor is selected. ?



**Grant Applications will be accepted on
an on-going basis throughout the summer.
If you have a project you would like to discuss,
please contact the ARTS office, 864-656-6799.**